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CATCH AND EFFORT STATISTICS FOR
THE SOCKEYE SALMON SPORT FISHERY
IN THE RUSSIAN RIVER WITH ESTIMATES
OF ESCAPEMENT, 1988[1]

By

Stephen L. Hammarstrom
and
David E. Athons

Alaska Department of Fish and Game
Division of Sport Fish
Juneau, Alaska 99802

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ABSTRACT

A creel survey of the recreational fishery on the Russian River was conducted during 1988 to determine angler effort and the harvest of sockeye salmon *Oncorhynchus nerka*. From these surveys, it was estimated that anglers expended 186,389 angler-hours to harvest 54,782 sockeye salmon from the early run (11 June-15 July) and 94,839 angler-hours to harvest 19,536 sockeye salmon from the late run (16 July-9 August). The fishery was closed by emergency order on 10 August to insure the escapement goal of 30,000 late-run spawners would be achieved. A total of 92,882 sockeye salmon was counted through the weir at the outlet of Lower Russian Lake bound for spawning areas upstream of the weir; 50,406 and 42,476 from the early and late runs, respectively. Early-run fish sampled at the weir were predominantly age 2.3 (93.9 percent) whereas late-run fish sampled at the weir were comprised of three major age classes; 2.3 (13.6 percent), 2.2 (46.9 percent), and 2.1 (28.5 percent). Ground surveys of late-run sockeye salmon spawning downstream of the weir indicated a peak count of 30,364 that were predominantly age 1.3 (89.6 percent).

INTRODUCTION

The Russian River is a clear-water stream located in the central Kenai Peninsula near Cooper Landing, Alaska. The drainage includes two large clear-water lakes, Upper and Lower Russian Lakes, and terminates in the Kenai River, approximately midway between Kenai and Skilak Lakes (Figure 1). The river supports the largest recreational fishery for sockeye salmon *Oncorhynchus nerka* in Alaska (Mills 1988). The fishery occurs in the Russian River and at its confluence with the Kenai River. Annual effort by anglers in this fishery has exceeded 450,000 angler-hours and annual harvests have exceeded 190,000 fish.

Prior information pertaining to effort and harvest in the sport fishery are presented by Lawler (1963-1964), Engel (1965-1972), Nelson (1973-1985), Nelson et al. (1986), McBride and Athons (1987), and Hammarstrom and Athons (1988). Unknown numbers of sockeye salmon of Russian River origin are also harvested by the sport fishery in the mainstem of the Kenai River, the personal-use dip net fishery in the Kenai River, and the commercial fishery in Upper Cook Inlet. Estimates of the total harvest of sockeye salmon by sport fisheries in the mainstem of the Kenai River have been reported annually since 1977 by Mills (1979-1988). The dip net harvest is estimated in the Statewide Harvest Survey (Mills 1988). The commercial harvest and total returns of sockeye salmon to the Kenai River have been reported by Cross et al. (1983, 1985, 1986).

Sockeye salmon return to the Russian River in two temporal components, termed early and late runs. The early run typically arrives at the Russian/Kenai River confluence in early June. By mid July, these fish have migrated through the Russian River and into Upper Russian Lake. Early-run fish spawn almost exclusively in Upper Russian Creek (Nelson 1973, 1974) and are comprised primarily of 3-ocean fish (Nelson et al. 1986). Early-run fish typically remain in the confluence area for up to 2 weeks before continuing their migration. Late-run sockeye salmon arrive at the confluence in mid to late July, move almost immediately into the Russian River, and are present in the area open to fishing through August. Late-run fish are comprised of two segments, those spawning upstream of the weir and those spawning downstream of the weir. While most fish passing through the weir spawn in Upper Russian Lake, others spawn in the tributaries to Upper Russian Lake and in the river section between the upper and lower lakes. These fish are primarily 2-ocean fish and are believed to rear in the two lakes. The other segment, spawning in the Russian River downstream from the falls, is primarily 3-ocean fish and is more closely associated with the age structure of sockeye salmon spawning in the mainstem Kenai River. These fish are believed to spend their fresh water residency in Skilak Lake.

The Sport Fish Division of the Department of Fish and Game regulates the recreational fishery to ensure a minimum number of spawning sockeye salmon[1]

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[1] Current escapement goals for the early and late runs are 9,000 and 30,000 fish, respectively.
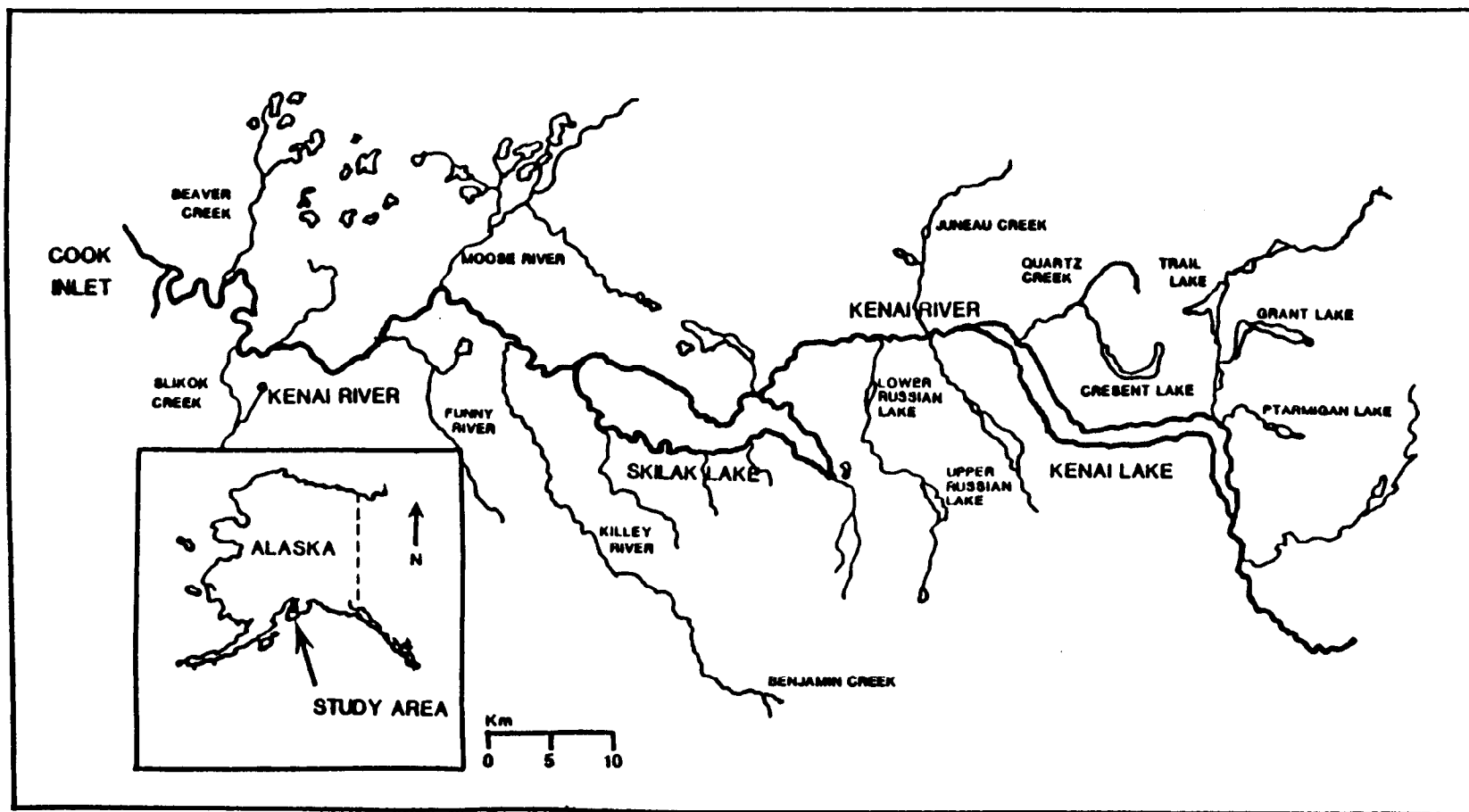
Figure 1. Map of the Kenai River drainage.

for each run pass through a weir at the outlet of Lower Russian Lake. The current escapement goals were established in 1975 and first applied to the 1976 return. Only in 1977 has the escapement goal not been achieved since the goals were established.

During 1988, the daily bag and possession limit for sockeye salmon in the Kenai/Russian River fly-fishing-only area was three fish which were 406 mm (16 in) or more in total length. The open season was from 1 June through 20 August. Within this area, from a marker located 540 m (600 yd) downstream from the Russian River falls to a marker located on the Kenai River 1,620 m (1,800 yd) downstream of the confluence with the Russian River, only a single unbaited, unweighted fly with a point-to-shank measurement of 9.5 mm (3/8 in) or less could be used. Any weights attached to the line had to have been a minimum of 457 mm (18 in) above the hook.

The recreational fishery in the Russian River is the largest recreational fishery for sockeye salmon in the state and there is a potential for over-harvest. To ensure adequate escapement requires precise and timely manage-ment decisions. The data necessary for these decisions are provided by a creel survey and a counting weir. The creel survey provides in-season data on angler effort and harvest. The weir operations provide daily escapements. Estimates of the total in-river return (harvest plus escapement) and the age, sex, and size compositions of the return provide information used to evaluate production and to estimate optimum spawning escapement levels.

The objectives of this report are to present, for 1988: (1) estimates of effort and harvest of sockeye salmon by the recreational fishery; and, (2) estimates of the escapements of the early and late-run return of sockeye salmon.

METHODS

Study Area

The recreational fishery occurs in two areas: (1) the confluence area, which extends from the upper limit marker of the sanctuary area[2] downstream approx-imately 1.6 km to a marker on the Kenai River identifying the downstream limit of the "fly-fishing-only" area; and (2) the river area, which extends from the upper limit of the sanctuary area upstream approximately 3.2 km on the Russian River to a marker identifying the upper limit of the "fly-fishing-only" area (Figure 2). Access to the two fishing areas is primarily through a United States Forest Service (USFS) campground located on the east side of the Russian River or through the parking area located on the north bank of the Kenai River directly across from the Russian River terminus which is operated by the United States Fish and Wildlife Service (USFWS). Immedi-ately adjacent to the USFWS parking area is a cable ferry across the Kenai

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[2] The sanctuary area begins in the Russian River, 137 m upstream of the con-fluence with the Kenai River and extends downstream in the Kenai River to the ferry cable (approximately 640 m).
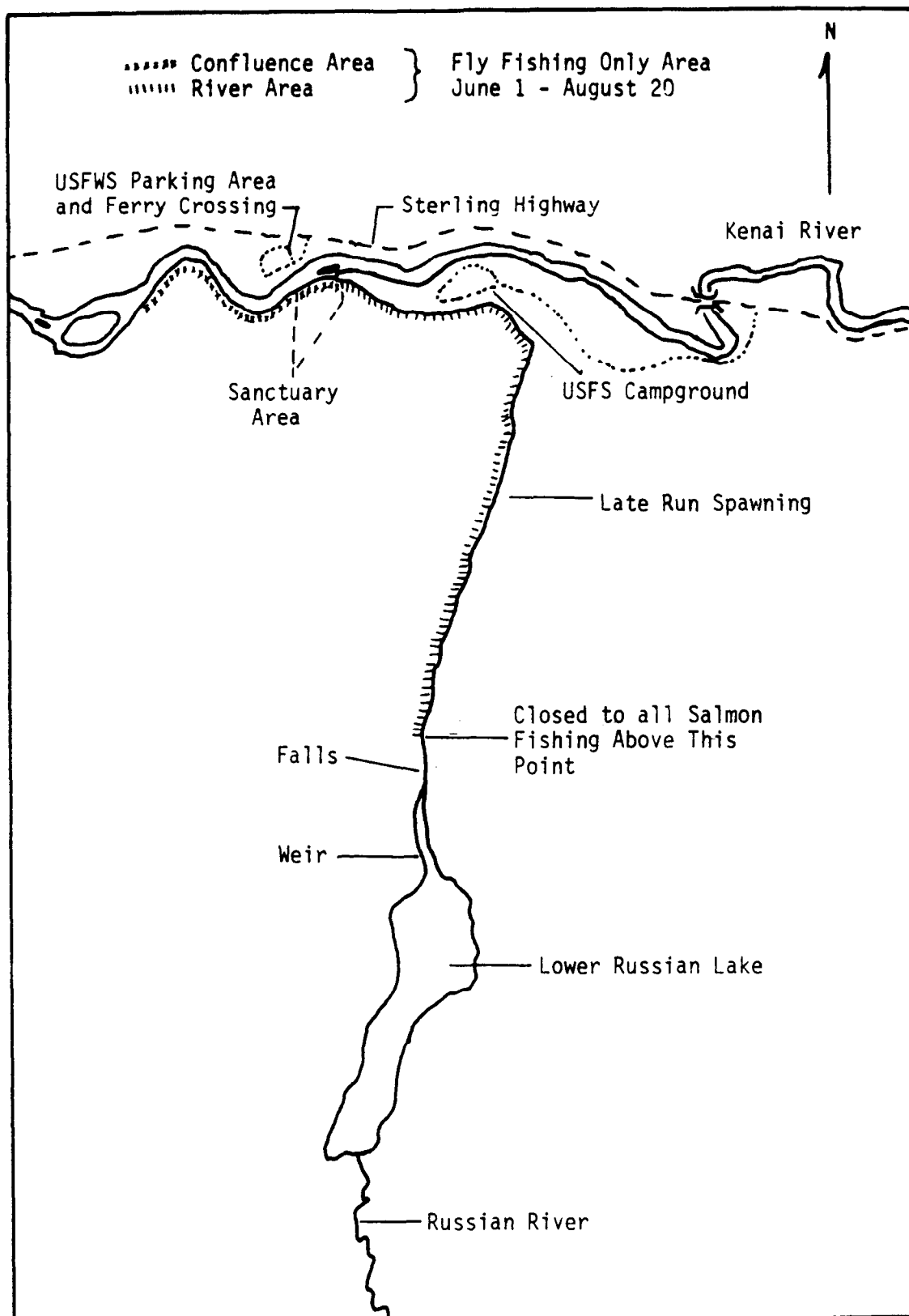
Figure 2. Map of the lower Russian River and the Kenai and Russian River confluence.

River which is operated privately under a concession administered by the USFWS. Most anglers fishing the confluence area use the ferry to reach the south bank of the Kenai River.

A weir, constructed of steel and wood, is located just below the outlet of Lower Russian Lake. The weir allows for the complete enumeration of the early-run spawners but not of late-run spawners, as late-run fish also use the portion of the river below the weir for spawning. These fish are enumerated through foot surveys.

Creel Surveys

The fishery was divided into four components based on run timing and area of the fishery:

1. Early run/confluence area   11 June   - 26 June;
2. Early run/river area   27 June   - 10 July;
3. Late run/confluence area   11 July   - 31 July; and,
4. Late run/river area   01 August - 09 August.

Differentiation between the two runs was based on subjective observations of harvest rates and external maturation characteristics of harvested sockeye salmon. Entry of late-run fish into the fishery has historically been typified by a surge of ocean-bright fish numerically overwhelming the remaining, more sexually advanced early-run fish. Immediately following the arrival of these ocean-bright fish there is usually a dramatic increase in the harvest rate in the confluence area. Each component was further stratified into weekdays and weekend/holidays, as historically, effort on weekdays has been less than on weekend days.

A roving creel survey (Neuhold and Lu 1957), using a stratified random sampling design, was used to count anglers, conduct angler interviews, and sample the sport harvest. The fishing day during the early run was defined as 24 hours long from 0000-2400 and was stratified into four periods: A from 0600-1159, B from 1200-1759, C from 1800-2359 and D from 2400-0559. In previous years, effort during period D has been considered insignificant; however, observations during 1987 indicated that effort during this period may be significant during the early run, especially when very large numbers of fish are present. Since this is the time of the summer solstice (the longest day being 21 June), varying degrees of twilight occur during period D. Also, the ferry ceases operation from 2300 - 0700 thereby restricting access to the south bank of the Kenai River.

The fishing day during the late run was defined as 18 hours long from 0600-2400 and was stratified into three periods: A from 0600-1159, B from 1200-1759, and C from 1800-2359. Period D was not sampled during the late run because declining daylight appears to discourage anglers and casual observations by survey clerks have not indicated significant participation during hours of darkness.

Historically, the area receiving the most fishing effort changes during the season as the concentration of fish moves from the confluence area into the

river area. To accommodate this trend, sampling effort was concentrated in the area receiving the most pressure as the season progressed.

A minimum of two angler counts was scheduled during periods A, B, and C of the weekday and weekend/holiday strata of each component of the fishery. Two hours were allotted for the counts in the river area (1 hour counting and 1 hour travel time to/from the physical limits of the area) and 1/2 hour for counts in the confluence area. Counts during period D were scheduled as individuals from other projects could be released from their duties with the objective to gain some quantitative data measuring participation during this previously unsampled time. Sampling effort was distributed about equally among the three daily periods. Days to be sampled were randomly selected on a weekly basis. Sample periods for each area were then selected for each day. Count times were selected randomly within each period selected for sampling. Counts during adjacent periods in the same sample area were scheduled 6 hours apart to minimize the covariance among counts on the same day. All counts reflected fishing effort at the time of the count and were considered to be instantaneous (Neuhold and Lu 1957).

The remaining time in a selected sample period not used for a count was used to conduct interviews of completed-trip anglers such that 7 hours of survey time were scheduled each day. Interviews were conducted at one of two places: (1) the trail head leading from the USFS campground to the Russian River; or (2) the ferry crossing adjacent to the USFWS parking area. The following information was recorded for each completed-trip angler interviewed: (1) number of hours fished; (2) location fished, river or confluence; and (3) number and species of fish retained.

The number of angler-hours of effort (E_t) during each component and stratum was estimated as follows (Neuhold and Lu 1957):

$$\hat{E}_t = \sum_{j=1}^{a} H_{tj}\bar{x}_{tj};$$ [1]

where:

$\bar{x}_{tj}$ = the mean number of anglers per count during period j (for the early run the number of periods, a, is equal to 4; for the late run, a is equal to 3) of fishery component t; and,

H_{tj} = the total number of hours of possible fishing time during period j of fishery component t.

The variance of effort was estimated as follows (Scheaffer et al. 1979):

$$V(\hat{E}_t) = \sum_{j=1}^{a} H_{tj}^2 (s_{tj}^2/n_{tj});$$ [2]

where:

s_{tj}^2 = the sample variance of $\bar{x}_{tj}$; and,

n_{tj} = the number of angler counts during period j of component t.

Mean effort and mean harvest of sockeye salmon per angler were estimated from the angler interview data for each of the components. Mean effort was estimated as:

$$\bar{f}_t = (\sum_{i=1}^{D} \sum_{k=1}^{m_i} f_{ik})/ \sum_{i=1}^{D} m_i; \qquad [3]$$

where:

f_{ik} = the effort (in hours) by angler k interviewed on day i;

m_i = the number of anglers interviewed on day i; and,

D = the number of days the fishery was open during component t.

The variance of mean effort was estimated using a two-stage sample design with days representing the first-stage sample units and anglers the second-stage sample units (Von Geldern and Tomlinson 1973). On a given sample day, the number of second-stage units available was unknown. The variance of mean effort was estimated as follows (Sukhatme et al. 1984):

$$V(\bar{f}_t) = [1 - (d/D)] \, s_B^2/d + (\sum_{i=1}^{D} s_{Wi}^2/m_i)/dD; \qquad [4]$$

where:

d = the number of days sampled during component t;

s_{Wi}^2 = the sample variance of effort for anglers interviewed during day i; and,

s_B^2 = the between-day variance of angler effort.

The between-day variance, s_B^2, was estimated as follows:

$$s_B^2 = [\sum_{i=1}^{D} (\bar{f}_{ti} - \bar{f}_t)^2]/(d-1); \qquad [5]$$

where:

$\bar{f}_{ti}$ = the mean effort by anglers interviewed during day i of component t.

Mean harvest and its variance were estimated identically to effort except the corresponding quantities for the harvest of sockeye salmon were substituted for all occurrences of effort (f).

Harvest rate of sockeye salmon (HPUE) during component t was estimated by:

$$HPUE_t = \bar{c}_t/\bar{f}_t; \qquad [6]$$

where:

$\bar{c}_t$ = the mean harvest of sockeye salmon per angler during fishery component t.

The variance of $HPUE_t$ was approximated by the variance for the quotient of the mean of two random variables (Jessen 1978), which is:

$$V(\bar{c}_t/\bar{f}_t) \approx (\bar{c}_t/\bar{f}_t)^2 (s_c^2/\bar{c}_t^2 + s_f^2/\bar{f}_t^2 - 2rs_c s_t/\bar{c}_t\bar{f}_t); \qquad [7]$$

where:

s_c^2 = the two-stage variance estimate for $\bar{c}_t$;

s_f^2 = the two-stage variance estimate for $\bar{f}_t$; and,

r = the correlation coefficient between the f_{ik} and the c_{ik} in component t.

The harvest of sockeye salmon during each component of the Russian River fishery was estimated by:

$$\hat{H}_t = \hat{E}_t HPUE_t. \qquad [8]$$

The variance of $\hat{H}_t$ was estimated using Goodman's (1960) formula for the variance of the product of two independent random variables, which is:

$$V(\hat{H}_t) = [\hat{E}_t^2 V(HPUE_t)] + [HPUE_t^2 V(\hat{E}_t)] - [V(\hat{E}_t) V(HPUE_t)]. \qquad [9]$$

Totals (for example, the early run total) for effort and harvest were estimated by summing the appropriate components. Estimates of effort and harvest for the components were considered independent estimates, therefore, the variance of the total was estimated by the sum of the appropriate variances.

The assumptions necessary for these analyses are:

1. significant fishing effort occurs only between the hours defined for the angler-day;

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2. individual angler effort and angler harvest are normally distributed random variables; and,
3. anglers are interviewed in proportion to their abundance (DiConstanzo 1956) and interviewed anglers are representative of the total angler population.

Spawning Escapement

The escapement of spawning sockeye salmon into the Russian River drainage (Figure 1) was enumerated at a weir on the outlet of Lower Russian Lake using methods similar to those described by Nelson (1976). The weir was operated from 17 June through 11 September. The weir was constructed of steel and wood with pickets leading to a holding box through which fish were individually counted. During the period of overlap between the early and late runs (late July through early August), fish from each run were subjectively identified by degree of external maturation and counted separately. This procedure began 17 July when bright fish were present with mature early-run fish and continued through 21 July when mature fish were no longer present.

Salmon spawning below the weir and downstream to the confluence of the Kenai River were enumerated by foot survey on two occasions approximately 1 week apart. These data were considered minimum escapement estimates and were not a complete enumeration of the escapement.

Age, Sex, and Length Sampling

Four groups of sockeye salmon were sampled for biological data: (1) early-run fish at the weir, (2) late-run fish at the weir, (3) late-run fish spawning below the weir, and (4) late-run fish harvested in the confluence area (which includes sockeye salmon from the mainstem Kenai River). The early-run escapement was sampled in two temporal components, one before the peak and one after the peak in the return. The late run was sampled in three components. Fish spawning below the weir were sampled by examining carcasses along the bank of Russian River. The confluence harvest was scheduled to be sampled in two temporal components, also, one before and one after the peak of the return. The fishery was closed by Emergency Order August 10 and the second component was therefore not obtained.

Scales were collected from the preferred area of each sampled fish and placed on adhesive-coated cards (Clutter and Whitesel 1956). The sex and length (measured from the mid-eye to fork of the tail in millimeters) of each sampled fish was also determined and recorded. Scale impressions were made in acetate and examined with a microfiche reader for aging. The European method of aging was used where the numeral preceding the decimal is the number of freshwater annuli and the numeral following the decimal is the number of marine annuli. Total age from brood is therefore the sum of the two numerals plus one.

Age and sex composition were estimated for each group of sockeye salmon sampled. Letting p_{hi} equal the estimated proportion of age group h in group i, the variance of p_{hi} was estimated using the normal approximation to the binomial (Scheaffer et al. 1979):

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$$V(\hat{P}_{hi}) = \hat{P}_{hi}(1-\hat{P}_{hi})/(n_{Ti}-1),$$ [10]

where n_{Ti} is the number of legible scales read from sockeye salmon sampled from group i.

The numbers of sockeye salmon by sex and age group were estimated for the early-run and late-run harvests and escapements. The early-run escapement sample was applied to both the escapement and early-run harvest. The samples from the late-run harvest and late-run escapements (through the weir and below the weir) were used to estimate the sex-age composition for these groups. The variances of the number harvested by sex-age group were estimated using Goodman's (1960) formula (Equation 9).

Mean length at age by sex and its variance were estimated using standard normal procedures.

RESULTS

Creel Statistics

Temporal changes in angler effort were apparent during the season and appear to correspond to the presence of the two runs of sockeye salmon returning to the Russian River system (Appendix Tables 1 and 2). Mean counts of anglers (by week) in both the river and confluence areas decreased sharply from late June through mid July before increasing again (Figure 3). The period of low effort between the peaks corresponded to the time of overlap between the early and late runs.

Generally, the mean count of anglers for weekdays was less than for weekends (Table 1). Effort for the early run was estimated as 186,389 angler-hours and 94,839 angler-hours for the late run (Table 2). Effort for both runs combined was estimated at 281,228 angler-hours. The confluence area received 52% of the early-run effort and 78% of the late-run effort. Effort during period D of the early run was estimated at 13,230 angler-hours, which represented 7% of the early-run total. The distribution of effort is similar to that of the 1986 fishery (McBride and Athons 1987).

Daily harvest per hour (HPUE) of sockeye salmon (Appendix Tables 3 and 6) in each area was bimodal corresponding to the timing of the early and late runs (Figure 4). The HPUE was greater in the river area on weekends during the early run and weekdays during the late run; the reverse was true for the confluence area (Table 3).

The harvest of sockeye salmon during the early run was estimated at 54,782 fish and the harvest during the late run was estimated at 19,536. Total harvest was estimated as 74,318 sockeye salmon with 58% of the harvest coming from the confluence area, 51% of the early run and 79% of the late run, respectively (Tables 4 and 5).

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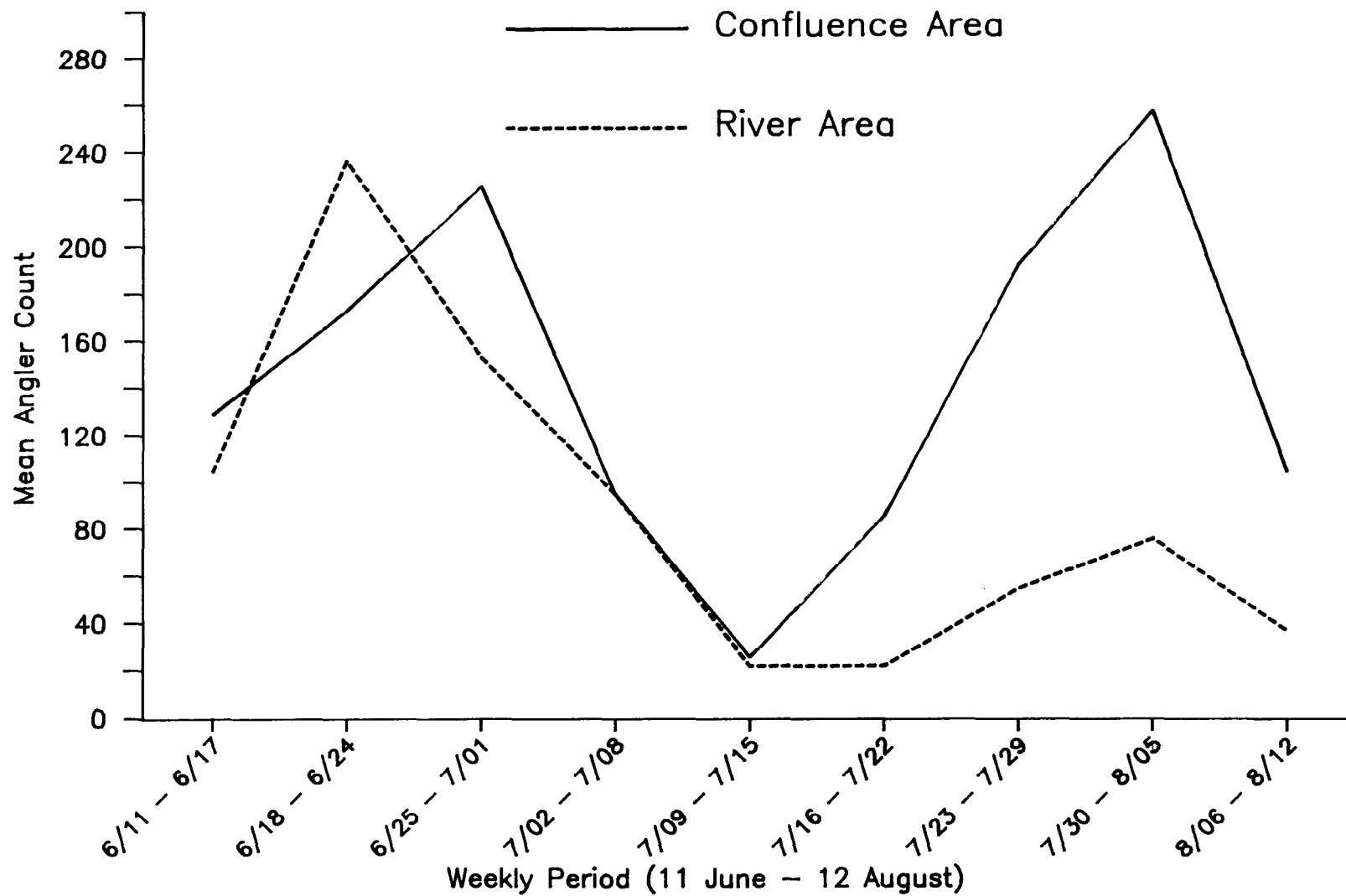
Figure 3. Mean angler count by week. and area in the Russian River recreational sockeye salmon fishery, 1988.

Table 1. Mean angler counts by period for each component of the Russian River creel survey, 1988.

| | Period[1] | | | | | | | |
| | Confluence | | | | River | | | |
	A	B	C	D	A	B	C	D
EARLY RUN								
Weekdays								
Number of counts	8	5	7	2	4	5	5	2
Mean Count	138.5	119.6	146.7	46.0	84.5	119.6	124.2	21.0
Standard error	27.4	44.1	33.3	29.7	12.8	51.6	55.2	5.7
Weekends								
Number of counts	9	5	6	1	5	5	5	1
Mean Count	156.1	188.4	103.5	97.0	143.2	181.6	131.2	77.0
Standard error	29.8	34.3	39.1		69.8	50.0	55.2	
LATE RUN								
Weekdays								
Number of counts	6	7	5		4	5	3	
Mean Count	138.2	196.6	127.8		60.0	51.6	25.3	
Standard error	25.8	23.3	27.9		21.0	9.1	6.4	
Weekends								
Number of counts	5	5	3		6	3	3	
Mean Count	99.4	274.2	180.7		55.3	55.3	37.0	
Standard error	38.9	63.8	98.6		21.1	15.7	14.7	

[1] Period A: 0600 - 1159.
  Period B: 1200 - 1759.
  Period C: 1800 - 2359.
  Period D: 2400 - 0559.

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Table 2. Estimated number of angler-hours of fishing effort during each component of the Russian River sockeye salmon fishery, 1988.

Component	Estimated Effort	Standard Error	95% Confidence Interval		Relative Precision
CONFLUENCE					
Early Run					
Weekdays	58,283	8,878	40,892 -	75,694	29.9%
Weekends	29,568	3,953	21,820 -	37,316	26.2%
Period D	8,330	3,950	588 -	16,072	92.9%
Total	96,191	10,490	75,630 -	116,752	21.4%
Late Run					
Weekdays	47,179	4,547	38,267 -	56,091	18.9%
Weekends	26,605	5,937	14,969 -	38,241	43.7%
Total	73,784	7,478	59,128 -	88,440	19.9%
Total					
Weekdays	105,462	9,975	85,912 -	125,012	18.5%
Weekends	56,173	7,133	42,193 -	70,153	22.9%
Period D	8,330	3,950	588 -	16,072	92.9%
Total	169,975	12,883	144,725 -	195,225	14.9%
RIVER					
Early Run					
Weekdays	46,872	9,677	27,096 -	65,838	40.5%
Weekends	30,096	6,737	16,891 -	43,301	43.9%
Period D	13,230	4,385	4,636 -	21,824	65.0%
Total	90,198	12,580	65,541 -	114,855	27.3%
Late Run					
Weekdays	13,967	2,418	9,228 -	18,706	33.9%
Weekends	7,088	1,446	4,255 -	9,921	40.0%
Total	21,055	2,817	15,533 -	26,577	26.2%
Total					
Weekdays	60,839	9,975	41,290 -	80,389	32.1%
Weekends	37,184	6,890	23,679 -	50,689	36.3%
Period D	13,230	4,385	4,636 -	21,824	65.0%
Total	111,253	12,892	85,985 -	136,521	22.7%
GRAND TOTAL					
Weekdays	166,301	14,107	138,652 -	193,950	16.6%
Weekends	93,357	9,917	73,919 -	112,795	20.8%
Period D	21,560	5,902	9,993 -	33,127	53.6%
Total	281,228	18,226	245,506 -	316,950	12.7%
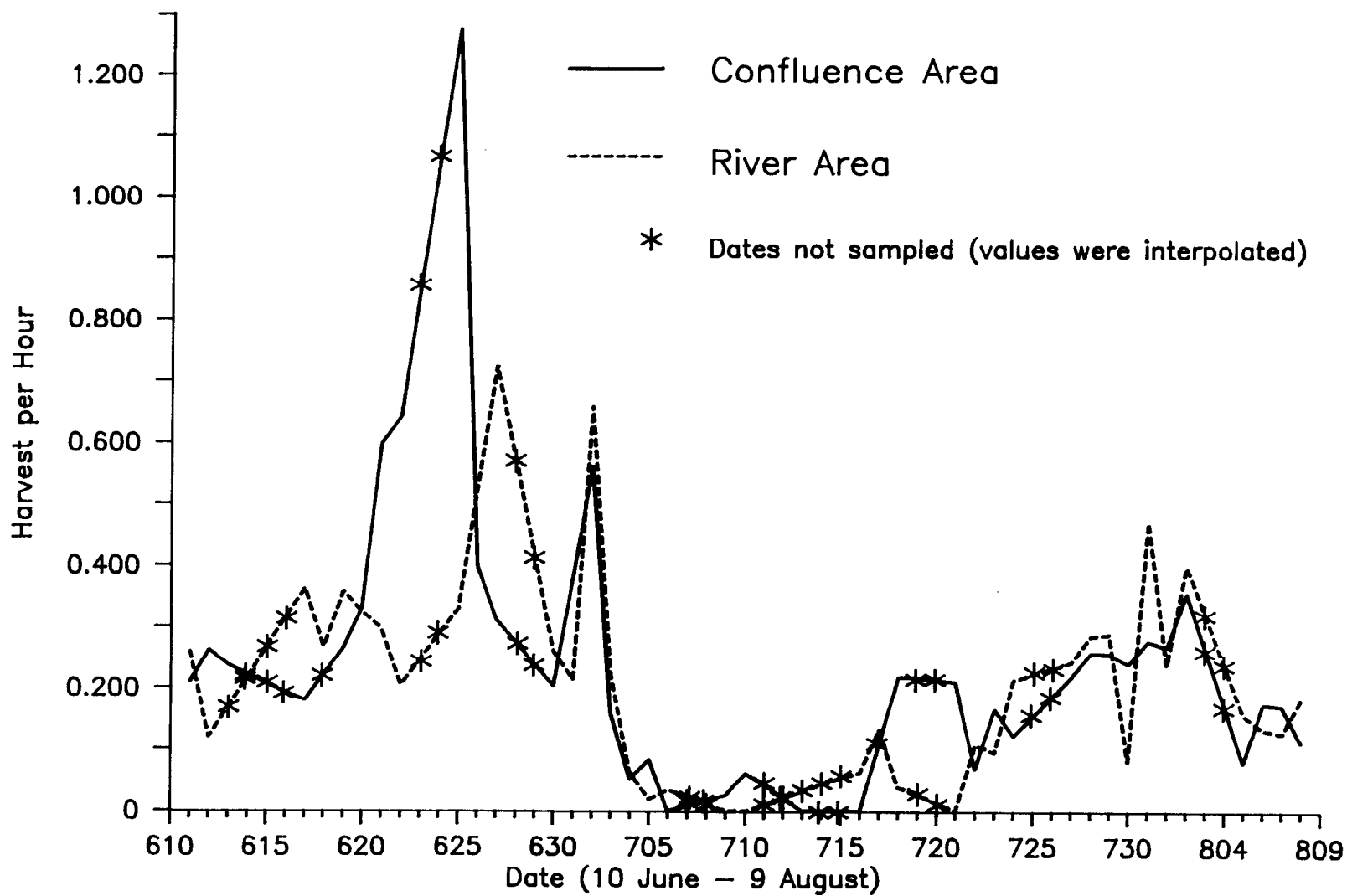
Figure 4. Mean harvest of sockeye salmon per hour by date and area in the Russian River recreational fishery, 1988.

Table 3. Estimated harvest per unit effort (HPUE) of sockeye salmon by anglers interviewed during each component of the Russian River fishery, 1988.

Stratum	Days n[1]	N[2]	Number of Interviews	HPUE	Standard Error
CONFLUENCE					
Early Run					
Weekdays	11	24	441	0.3086	0.0405
Weekends	10	11	447	0.2560	0.0221
Late Run					
Weekdays	10	17	303	0.2072	0.0240
Weekends	7	8	327	0.2119	0.0206
RIVER					
Early Run					
Weekdays	9	24	240	0.2849	0.0514
Weekends	11	11	212	0.3175	0.0200
Late Run					
Weekdays	10	17	123	0.2158	0.0330
Weekends	8	8	118	0.1565	0.0312

[1] Number of days on which interviews were conducted.

[2] Number of days possible for conducting interviews.

Table 4. Estimated number of sockeye salmon harvested during each component of the Russian River fishery, 1988.

Stratum	Estimated Harvest	Standard Error	95% Confidence Interval		Relative Precision
CONFLUENCE					
Early Run					
Weekdays	17,989	3,598	10,937 -	25,041	39.2%
Weekends	7,569	1,202	5,214 -	9,924	31.1%
Period D	2,355	1,131	138 -	4,572	94.2%
Total	27,913	5,959	20,154 -	35,672	27.8%
Late Run					
Weekdays	9,775	1,470	6,894 -	12,656	29.5%
Weekends	5,638	1,366	2,960 -	8,316	47.5%
Total	15,413	2,007	11,480 -	193467	25.5%
Both Runs					
Weekdays	27,764	3,887	20,146 -	35,382	27.4%
Weekends	13,207	1,820	9,641 -	16,773	27.0%
Period D	2,355	1.131	138 -	4,572	94.2%
Total	43,326	4,439	34,627 -	52,025	20.1%
RIVER					
Early Run					
Weekdays	13,354	3,629	6,242 -	20,466	53.3%
Weekends	9,555	2,219	5,207 -	13,903	45.5%
Period D	3,960	1,375	1,264 -	6,656	68.1%
Total	26,869	4,470	18,108 -	35,630	32.6%
Late Run					
Weekdays	3,014	692	1,658 -	4,370	45.0%
Weekends	1,109	313	495 -	1,723	55.4%
Total	4,123	759	2,635 -	5,611	36.1%
Both Runs					
Weekdays	16,368	3,694	9,127 -	23,609	44.2%
Weekends	10,664	2,241	6,272 -	15,056	41.2%
Period D	3,960	1,375	1,264 -	6,656	68.1%
Total	30,992	4,534	22,105 -	39,879	28.7%
GRAND TOTAL					
Weekdays	44,132	5,362	33,622 -	54,642	23.8%
Weekends	23,871	2,887	18,212 -	29,530	23.7%
Period D	6,315	1,780	2,825 -	9,805	55.3
Total	74,318	6,345	61,882 -	86,754	16.7%

Table 5. Summary of estimated angler-effort and harvest of sockeye salmon by run for each area of the Russian River fishery, 1988.

Component	Confluence Area	River Area	Total	95% Confidence Interval
EARLY RUN				
Effort	96,191	90,198	186,389	154,284 - 218,494
SE[1]	10,490	12,580	16,380	
Harvest	27,913	26,869	54,782	43,079 - 66,485
SE	3,959	4,470	5,971	
LATE RUN				
Effort	73,784	21,055	94,839	79,177 - 110,501
SE	7,479	2,817	7,991	
Harvest	15,413	4,123	19,536	15,331 - 23,741
SE	2,007	759	2,146	
TOTAL BOTH RUNS				
Effort	169,975	111,253	281,228	245,506 - 316,950
SE	12,883	12,892	18,225	
Harvest	43,326	30,992	74,318	61,882 - 86,754
SE	4,439	4,534	6,345	

[1] Standard error.

Spawning Escapement

The escapement of sockeye salmon early run and late run through the weir were 50,406 and 42,476 fish, respectively (Appendix Table 7, Table 6). Transition between the two runs occurred between 17 July and 21 July (Figure 5). The weir was removed 11 September by which time the sockeye salmon migration was virtually complete, however, the coho salmon migration was still in progress and the count was therefore incomplete.

Age, Sex, and Length Statistics

The predominant age group (93.9%) of the early run was 2.3 (Appendix Table 8). The late run through the weir was comprised of five age groups; 1.2, 1.3, 2.1, 2.2, and 2.3, with age group 2.2 being the greatest at 46.9%. (Appendix Table 9). Three-ocean fish contributed 17.3% and 1-ocean (precocial males) 28.5% to the total escapement. The largest proportion of 3-ocean fish occurred during the period 17 July-1 August, while 1-ocean fish returned predominantly during the period of 17 August-11 September. Late-run sockeye salmon spawning downstream of the weir were nearly 90% age group 1.3 (Appendix Table 10).

It was assumed based on past years' data (McBride and Athons 1987) the early-run harvest was not selective among age groups and therefore the age composition of the early-run harvest was assumed to be similar to that of the escapement. Age group proportions of the samples collected at the weir before and after the peak of the return were not significantly different ($P > 0.05$); therefore, the samples were combined to estimate the age composition of the early-run harvest. The late-run harvest in the confluence area was composed of three major age groups; 2.2 (56.1%), 1.3 (20.6%) and 2.3 (15.4%) (Appendix Table 11).

Mean length by sex of the four populations generally increased by age group (Appendix Table 12). The estimated escapements for both runs through the weir, the escapement downstream of the weir, and the estimated early-run and late-run harvests are apportioned by age group (Table 7). The primary brood year for the early run was 1982 (93.9%). Brood years 1982, 1983, and 1984 all contributed to the late-run escapement; 13.6%, 50.6%, and 35.8%, respectively. The 1983 brood year composed 90.6% of the escapement downstream of the weir and 76.7% of the late-run harvest.

CONCLUSIONS AND RECOMMENDATIONS

In 1988, the return of early-run sockeye salmon to the Russian River was the second largest recorded, the record being established in 1987. The total estimated harvest of 54,782 fish was also the second largest recorded, 2.9 times larger than the 1963-1987 mean. The escapement of 50,406 fish was the third largest following the 1982 and 1987 escapements of 56,080 and 61,515 fish, respectively. The 1982 escapement of 56,080 produced a total return of over 274,898 fish or 4.90 return per spawner (McBride and Athons 1987, Hammarstrom and Athons 1988). This return per spawner will be used in

Table 6. Escapements of sockeye, coho, and chinook salmon in the
Russian River, 1988.

Component	Dates	Sockeye Salmon	Coho Salmon	Chinook Salmon
Early Run[1]	06/17 - 07/20	50,406		
Late Run[1]	07/17 - 09/11	42,476	607[2]	117
Downstream[3]	08/22	30,363[4]		19[5]
	08/31	22,906[6]		18[7]

[1] From 7/17 through 7/20, early run fish were differentiated from
late run fish based on the degree of external maturation
(color).

[2] Only a partial count as the weir was removed prior to
completion of migration.

[3] Fish that spawned downstream from the Russian River weir.

[4] 29,592 live fish, 771 dead fish.

[5] 15 live fish, 4 dead fish.

[6] 15,370 live fish, 7,536 dead fish.

[7] 12 live fish, 6 dead fish.
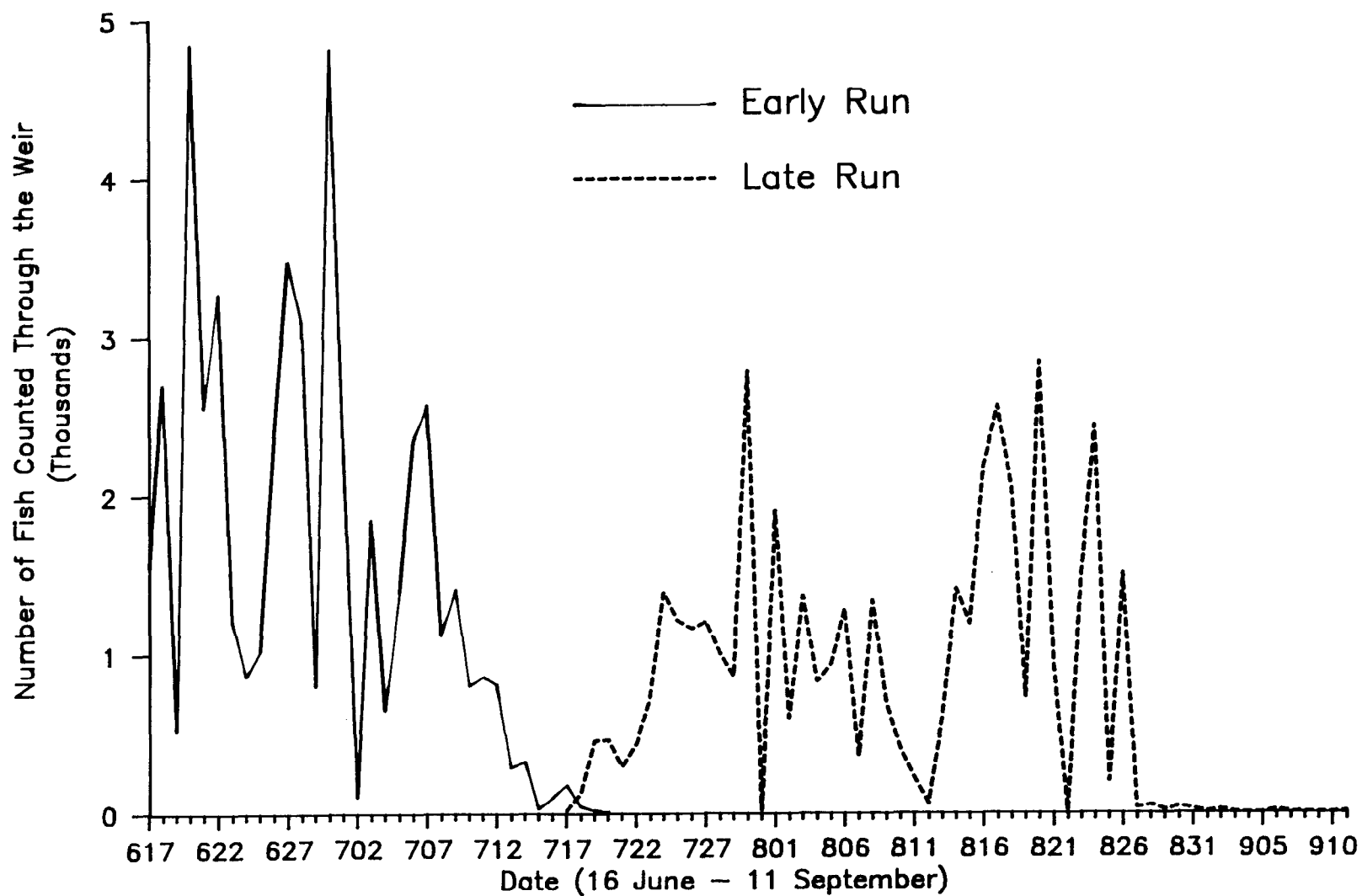
Figure 5. Daily escapement of sockeye salmon counted through the Russian River weir, 1988.

Table 7. Estimated age composition and numbers by age group of the harvest and escapement of sockeye salmon in the Russian River, 1988.

Brood Year	1982	1983		1984		
Age Group	2.3	1.3	2.2	1.2	2.1	Total

ESCAPEMENT

Early Run[1]

Percent	93.9	3.8	1.5	0.8	0	100.0
Number	47,331	1,915	756	404	0.0	50,406

Late Run[1]

Percent	13.6	3.7	46.9	7.3	28.5	100.0
Number	5,767	1,573	19,930	3,118	12,088	42,476

Downstream[2]

Percent	5.2	89.6	1.0	2.0	1.0	100.0
Number	1,579	27,204	304	881	304	30,363[3]

HARVEST

Early Run

Percent	93.9	3.8	1.5	0.8	0.0	100.0
Number	51,440	2,081	882	438	0	54,782

Late Run

Percent	15.4	20.6	56.1	7.9	0.0	100.0
Number	3,008	4,024	10,960	1,543	0	19,536

[1] Fish that passed through the weir.

[2] Fish that spawned downstream from Russian River Falls.

[3] Peak count from foot survey.

conjunction with return per spawner data from other spawner years, to redefine the escapement goal for early-run sockeye salmon in the Russian River.

Angler-effort during the early run of 186,389 angler-hours was surpassed only by 1987 with 319,823 (Hammarstrom and Athons 1988) and 1978 with 196,600 (Nelson 1979). Mean HPUE (0.294) was 1.8 times the 1963-1987 mean exceeded only by the record (0.482) which occurred in 1987 (Hammarstrom and Athons 1988).

The late-run return of 62,012 was slightly less than the historic mean of 64,968 while the harvest of 19,536 was slightly greater than the historic mean of 16,280. Due to a later than historic (about 1-2 weeks) escapement, the fishery was closed by Emergency Order on 10 August. Daily counts of anglers increased beginning 14 August due to a large number of returning age 2.1 fish. These precocial males made up 28.5% of the total late-run escapement.

Angler-effort during the late run was 40% greater then the historical mean while HPUE was 14% less. Observations by staff indicated that fish in relatively advanced stages of maturation were present in the fishery by late July. These fish were predominant in the confluence area during the last few days of the fishery and most anglers were releasing several before retaining a "bright" fish.

For the 1989 season, weir installation should occur prior to 15 June as significant numbers of fish were present when the weir was installed on 17 June in 1988. Age structure sampling was adjusted to include a third temporal segment in-season in 1988. This should be incorporated into the 1989 operational plan.

ACKNOWLEDGEMENTS

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APPENDIX

Appendix Table 1. Angler counts in the Russian River early-run sockeye salmon fishery, 1988.

Date	Wd/We[2]	River Fishery Period[1]				Confluence Fishery Period			
		A	B	C	D	A	B	C	D
611	We	80		48		84	102		
612	We					151		119	
613	Wd						101	105	
614	Wd								
615	Wd								
616	Wd								
617	Wd			187		172		199	
618	We		338	318		51	257		
619	We		230			205		141	
620	Wd	115				180	174		
621	Wd		316	238	17	120		112	67
622	Wd			103		180		315	
623	Wd								
624	Wd								
625	We	413		179	77	309		269	97
626	We	140				264	279		
627	Wd	96				222	259		
628	Wd								
629	Wd								
630	Wd		108	72				97	
701	Wd	66				191		152	
702	We	45		107		150			
703	We		182			134	168		
704	We		112				136	48	
705	Wd	61	94		25			47	25
706	Wd		65			26	52		
707	Wd								
708	Wd								
709	We	38				57		33	
710	We		46	4				11	
711	Wd		15			17			
712	Wd			7					
713	Wd						12		
714	Wd								
715	Wd								

[1] Period A: 0600 - 1159.
  Period B: 1200 - 1759.
  Period C: 1800 - 2359.
  Period D: 2400 - 0559.

[2] Weekday (Wd) or Weekend (We).

Appendix Table 2. Angler counts in the Russian River late-run sockeye salmon fishery, 1988.

Date	Wd/We[2]	River Fishery Period[1]			Confluence Fishery Period		
		A	B	C	A	B	C
716	We	4		12	14		36
717	We	18			18		
718	Wd		35			126	94
719	Wd						
720	Wd						
721	Wd			14	39		138
722	Wd		50		139	170	
723	We		30			248	137
724	We		84		175		
725	Wd						
726	Wd						
727	Wd			26		217	141
728	Wd	46			147		217
729	Wd	110			201	255	
730	We	141		63		456	369
731	We	85			202	384	
801	Wd		49	36		252	
802	Wd		86		205	247	
803	Wd						
804	Wd						
805	Wd	73			98	109	
806	We	61			88	130	
807	We	23	52			153	
808	Wd	11	38				49
809	Wd						

[1] Period A: 0600 - 1159.
 Period B: 1200 - 1759.
 Period C: 1800 - 2359.

[2] Weekday (Wd) of Weekend (We).

Appendix Table 3. Daily summary statistics for fishing effort and sockeye salmon harvest in the river segment of the Russian River fly-fishing-only area during the early run, 1988.

Date	Wd/We[1]	SS[2]	EFFORT (HRS) Mean	SE[3]	HARVEST Mean	SE	HPUE
611	We	15	2.6	0.23	0.67	0.287	0.260
612	We	16	1.6	0.14	0.19	0.136	0.120
617	Wd	43	3.8	0.34	1.40	0.211	0.363
618	We	26	5.3	0.45	1.42	0.273	0.267
619	We	35	3.1	0.27	1.11	0.227	0.358
620	Wd	20	3.7	0.31	1.20	0.296	0.324
621	Wd	46	4.6	0.29	1.37	0.187	0.297
622	Wd	9	4.3	0.36	0.89	0.309	0.205
625	We	15	4.0	0.60	1.33	0.319	0.331
626	We	33	3.5	0.37	1.88	0.245	0.530
627	Wd	15	3.4	0.29	2.47	0.274	0.725
630	Wd	54	3.8	0.31	0.98	0.162	0.260
701	Wd	14	3.7	0.56	0.79	0.281	0.214
702	We	15	3.5	0.36	2.33	0.252	0.660
703	We	22	3.3	0.41	0.73	0.239	0.222
704	We	29	3.4	0.39	0.21	0.077	0.062
705	Wd	16	3.4	0.42	0.06	0.063	0.019
706	Wd	23	2.5	0.36	0.09	0.060	0.034
709	We	2	1.8	0.25	0.00	0.000	0.000
710	We	4	0.9	0.13	0.00	0.000	0.000

[1] Weekday (Wd) or Weekend (We).
[2] Sample size, number of anglers interviewed.
[3] Standard error

Appendix Table 4. Daily summary statistics for fishing effort and sockeye salmon harvest in the confluence segment of the Russian River fly-fishing-only area during the early run, 1988.

Date	Wd/ We[1]	EFFORT (HRS)			HARVEST		
		SS[2]	Mean	SE[3]	Mean	SE	HPUE
611	We	58	4.5	0.34	0.95	0.136	0.210
612	We	99	3.9	0.22	1.04	0.110	0.263
613	Wd	68	4.5	0.26	1.06	0.159	0.237
617	Wd	18	5.0	0.95	0.89	0.322	0.179
619	We	102	5.2	0.27	1.37	0.121	0.266
620	Wd	75	4.1	0.24	1.35	0.156	0.332
621	Wd	20	2.8	0.28	1.65	0.319	0.600
622	Wd	46	3.4	0.26	2.22	0.167	0.644
625	We	10	1.8	0.37	2.30	0.335	1.278
626	We	64	4.0	0.25	1.58	0.169	0.398
627	Wd	64	5.2	0.34	1.61	0.147	0.311
630	Wd	32	5.5	0.68	1.13	0.249	0.203
701	Wd	68	4.1	0.26	1.59	0.149	0.385
702	We	14	2.5	0.23	1.43	0.388	0.563
703	We	33	3.5	0.43	0.55	0.175	0.157
704	We	48	3.6	0.26	0.19	0.082	0.052
705	Wd	38	4.4	0.35	0.37	0.127	0.084
706	Wd	7	2.4	0.43	0.00	0.000	0.000
709	We	11	3.5	0.39	0.09	0.091	0.026
710	We	8	4.1	0.64	0.25	0.164	0.062
713	Wd	5	2.3	0.12	0.00	0.000	0.000

[1] Weekday (Wd) or Weekend (We).
[2] Sample size, number of anglers interviewed.
[3] Standard error

Appendix Table 5. Daily summary statistics for fishing effort and sockeye salmon harvest in the river segment of the Russian River fly-fishing-only area during the late run, 1988.

Date	Wd/We[1]	SS[2]	EFFORT (HRS) Mean	SE[3]		HARVEST Mean	SE	HPUE
716	We	7	2.3	0.55	0.14	0.143	0.063	
717	We	9	2.5	0.46	0.33	0.333	0.133	
718	Wd	8	3.3	1.00	0.13	0.125	0.038	
721	Wd	7	1.5	0.19	0.00	0.000	0.000	
722	Wd	11	2.5	0.45	0.27	0.195	0.107	
723	We	29	2.6	0.40	0.24	0.128	0.095	
724	We	8	3.5	1.10	0.75	0.491	0.214	
727	Wd	11	1.9	0.43	0.45	0.282	0.244	
728	Wd	5	2.8	1.23	0.80	0.583	0.286	
729	Wd	16	2.8	0.37	0.81	0.332	0.289	
730	We	34	3.3	0.42	0.26	0.106	0.081	
731	We	15	3.1	0.38	1.47	0.322	0.473	
801	Wd	20	2.9	0.28	0.70	0.242	0.239	
802	Wd	15	3.0	0.40	1.20	0.312	0.400	
805	Wd	9	2.8	0.53	0.44	0.176	0.157	
806	We	6	2.5	0.95	0.33	0.211	0.133	
807	We	10	3.1	0.33	0.40	0.163	0.127	
808	Wd	21	4.4	0.45	0.81	0.203	0.184	

[1] Weekday (Wd) or Weekend (We).
[2] Sample size, number of anglers interviewed.
[3] Standard error

Appendix Table 6. Daily summary statistics for fishing effort and sockeye salmon harvest in the confluence segment of the Russian River fly-fishing-only area during the late run, 1988.

Date	Wd/We[1]	EFFORT (HRS)			HARVEST		
		SS[2]	Mean	SE[3]	Mean	SE	HPUE
716	We	3	1.3	0.33	0.00	0.000	0.000
718	Wd	48	4.7	0.37	1.04	0.166	0.220
721	Wd	14	6.5	0.93	1.36	0.357	0.210
722	Wd	14	2.1	0.22	0.14	0.097	0.069
723	We	74	3.8	0.29	0.64	0.121	0.167
724	We	46	2.6	0.29	0.33	0.103	0.123
727	Wd	60	3.2	0.24	0.70	0.139	0.219
728	Wd	50	5.2	0.39	1.34	0.170	0.259
729	Wd	41	4.8	0.34	1.24	0.197	0.257
730	We	65	4.5	0.23	1.09	0.164	0.240
731	We	81	4.2	0.25	1.17	0.135	0.278
801	Wd	13	4.3	0.59	1.15	0.373	0.268
802	Wd	5	2.8	0.49	1.00	0.447	0.357
805	Wd	46	4.1	0.28	0.33	0.099	0.079
806	We	41	3.3	0.27	0.59	0.152	0.175
807	We	17	2.4	0.38	0.41	0.243	0.171
808	Wd	12	5.2	0.87	0.58	0.288	0.113

[1] Weekday (Wd) or Weekend (We).
[2] Sample size, number of anglers interviewed.
[3] Standard error

Appendix Table 7. Daily escapement of sockeye, coho, and chinook salmon at the Russian River weir, 1988.

Date	Early Run[1] Sockeye	Late Run Sockeye	Coho	Chinook
6/17	1,552			
6/18	2,706			
6/19	523			
6/20	4,858			
6/21	2,555			
6/22	3,283			
6/23	1,221			
6/24	861			
6/25	1,032			
6/26	2,369			
6/27	3,479			
6/28	3,109			
6/29	800			
6/30	4,824			
7/01	2,276			
7/02	105			
7/03	1,854			
7/04	650			
7/05	1,400			
7/06	2,350			
7/07	2,579			
7/08	1,122			
7/09	1,419			
7/10	800			
7/11	863			
7/12	811			
7/13	290			
7/14	329			
7/15	29			
7/16	101			1
7/17	185	21		0
7/18	43	127		0
7/19	21	461		1
7/20	7	465		0
7/21		291		0
7/22		439		0
7/23		721		0
7/24		1,384		1
7/25		1,208		0
7/26		1,161		0
7/27		1,201		1
7/28		1,002		5
7/29		858		0
7/30		2,785		9
7/31		19		0
8/01		1,904		8

-Continued-

Appendix Table 7. Daily escapement of sockeye, coho, and chinook salmon at the Russian River weir, 1988 (continued).

Date	Early Run[1] Sockeye	Late Run Sockeye	Coho	Chinook
8/02		595		5
8/03		1,361		3
8/04		827		1
8/05		938		2
8/06		1,280		2
8/07		356		0
8/08		1,333		11
8/09		688		10
8/10		395		9
8/11		222	6	2
8/12		57	0	0
8/13		602	8	5
8/14		1,410	6	10
8/15		1,182	14	3
8/16		2,179	45	8
8/17		2,566	16	4
8/18		2,038	25	5
8/19		726	3	1
8/20		2,844	48	3
8/21		929	11	2
8/22		8	0	0
8/23		1,515	24	0
8/24		2,441	37	1
8/25		198	7	0
8/26		1,505	43	0
8/27		32	17	2
8/28		49	25	0
8/29		17	18	0
8/30		38	21	0
8/31		22	3	0
9/01		6	4	1
9/02		23	2	1
9/03		4	8	0
9/04		0	0	0
9/05		3	3	0
9/06		19	22	0
9/07		2	24	0
9/08		2	7	0
9/09		1	4	0
9/10		4	132	0
9/11		12	24	0
Totals	50,406	42,476	607	117

1 From 7/17 through 7/20, early run fish were differentiated from late run fish based on degree of external maturation.

Appendix Table 8. Estimated age and sex composition of sockeye salmon in the early run through the Russian River weir, 1988.

Dates	Age Group					
	2.3	1.3	2.2	1.2	2.1	Total
6/17 - 6/27 (n[1] = 135)						
Females						
Percent	61.5	3.7	0.0	0.0	0.0	65.2
Number	15,030	904	0	0	0	15,934
Males						
Percent	34.1	0.7	0.0	0.0	0.0	34.8
Number	8,334	171	0	0	0	8,505
Sexes Combined						
Percent	95.6	4.4	0.0	0.0	0.0	100.0
Number	23,364	1,075	0	0	0	24,439
Standard Error	435	1,430	0	0	0	
6/28 - 7/20 (n[1] = 128)						
Females						
Percent	49.2	2.3	2.3	0.8	0.0	54.6
Number	12,776	597	597	208	0	14,178
Males						
Percent	43.0	0.8	0.8	0.8	0.0	45.4
Number	11,166	208	208	2080	0	11,790
Sexes Combined						
Percent	92.2	3.1	3.1	1.6	0.0	100.0
Number	23,942	805	805	416	0	25,968
Standard Error	1,617	401	401	290	0	
Early Run Total						
Females						
Percent	55.5	3.0	1.1	0.4	0	60.0
Number	27,975	1,512	554	202	0.0	30,243
Males						
Percent	38.1	0.8	0.4	0.4	0	40.0
Number	19,356	403	202	202	0.0	20,163
Sexes Combined						
Percent	93.9	3.8	1.5	0.8	0	100
Number	47,331	1,915	756	404	0.0	50,406
Standard Error	2,160	598	379	277	0	

[1] n = sample size.

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Appendix Table 9. Estimated age and sex composition of sockeye salmon in the late run through the Russian River weir, 1988.

Dates	Age Group					
	2.3	1.3	2.2	1.2	2.1	Total

7/17 - 8/01 (n^1 = 122)

	2.3	1.3	2.2	1.2	2.1	Total
Females						
Percent	14.8	3.3	37.7	5.7	0.0	61.5
Number	2,079	464	5,294	801	0	8,638
Males						
Percent	12.3	5.7	18.9	1.6	0.0	38.5
Number	1,728	801	2,655	225	0	5,409
Sexes Combined						
Percent	27.1	9.0	56.6	7.3	0.0	100.0
Number	3,807	1,265	7,949	1,026	0	14,047
Standard Error	615	372	792	355	0	

8/02 - 8/16 (n^1 = 131)

	2.3	1.3	2.2	1.2	2.1	Total
Females						
Percent	5.3	1.5	36.6	13.0	0.0	56.4
Number	712	201	4,914	1,745	0	7,572
Males						
Percent	8.4	0.8	27.5	0.8	6.1	43.6
Number	1,128	107	3,692	107	819	5,853
Sexes Combined						
Percent	13.7	2.3	64.1	13.8	6.1	100.0
Number	1,840	308	8,606	1,852	819	13,425
Standard Error	418	176	770	408	280	

8/17 - 9/11 (n^1 = 129)

	2.3	1.3	2.2	1.2	2.1	Total
Females						
Percent	0.0	0.0	12.4	0.8	0.0	13.2
Number	0	0	1,860	120	0	1,980
Males						
Percent	0.8	0.0	10.1	0.8	75.2	86.8
Number	120	0	1,515	120	11,269	13,024
Sexes Combined						
Percent	0.8	0.0	22.5	1.6	75.2	100.0
Number	120	0	3,375	240	11,269	15,004
Standard Error	118	0	590	166	570	

-Continued-

Appendix Table 9. Estimated age and sex composition of sockeye salmon in the late run through the Russian River weir, 1988 (continued).

Dates	Age Group					
	2.3	1.3	2.2	1.2	2.1	Total
Late Run Total						
Females						
Percent	6.6	1.6	28.4	6.2	0.0	42.8
Number	2,791	665	12,068	2,666	0	18,190
Males						
Percent	7.0	2.1	18.5	1.1	28.5	57.2
Number	2,976	908	7,862	452	12,088	24,286
Sexes Combined						
Percent	13.6	3.7	46.9	7.3	28.5	100.0
Number	5,767	1,573	19,930	3,118	12,088	42,476
Standard Error	753	412	1,252	566	635	

[1] n = sample size.

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Appendix Table 10. Estimated age and sex composition of sockeye salmon which spawned downstream from the Russian River weir, 1988.

	Age Group					
	2.3	1.3	2.2	1.2	2.1	Total
(n[1] = 308)						
Females						
Percent	4.9	48.4	1.0	1.0	0.0	55.3
Number	1,488	14,695	304	304	0	16,791
Males						
Percent	0.3	41.2	0.0	1.9	1.0	44.7
Number	91	12,509	0	577	304	13,572
Sexes Combined						
Percent	5.2	89.6	1.0	2.9	1.0	100.0
Number	1,579	27,204	304	881	304	30,363
Standard Error	384	1,209	172	291	172	

[1] n = sample size.

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Appendix Table 11. Estimated age and sex composition of sockeye salmon harvested during the Russian River recreational fishery, 1988.

Component	Age Group					
	2.3	1.3	2.2	1.2	2.1	Total
Early Run[1] (n[2] = 263)						
Females						
Percent	55.5	3.0	1.1	0.4	0.0	60.0
Number	30,404	1,643	603	219	0	32,870
Males						
Percent	38.4	0.8	0.4	0.4	0.0	40.0
Number	21,036	438	219	219	0	21,912
Sexes Combined						
Percent	93.9	3.8	1.5	0.8	0.0	100.0
Number	51,440	2,081	882	438	0	54,782
Standard Error	4,660	674	416	302	0	
Late Run[3] (n[2] = 253)						
Females						
Percent	5.1	9.9	30.8	5.5	0.0	51.3
Number	996	1,934	6,017	1,074	0	10,022
Males						
Percent	10.3	10.7	25.3	2.4	0.0	48.7
Number	2,012	2,090	4,943	469	0	9,514
Sexes Combined						
Percent	15.4	20.6	56.1	7.9	0.0	100.0
Number	3,008	4,024	10,960	1,543	0	19,536
Standard Error	521	612	1,155	360	0	

[1] Assumes the age/sex composition of the harvest is similar to the escapement.

[2] n = sample number.

[3] Assumes the age/sex composition of the harvest at the confluence area is representative of the total late run harvest.

Appendix Table 12. Mean length (millimeters) at age by sex of sockeye salmon sampled from the Russian River, 1988.

Component		Age Class				
		2.3	1.3	2.2	1.2	2.1
Early Run Escapement[1]						
Female	Mean Length	593	583	548	515	
	SE[2]	1.9	10.3	7.3		
	Sample Size	146	8	3	1	
Male	Mean Length	597	608	580	480	
	SE	2.1	17.5			
	Sample Size	101	2	1	1	
Late Run Escapement[1]						
Female	Mean Length	584	583	545	523	
	SE	5.7	9.3	2.4	3.0	
	Sample Size	25	6	110	25	
Male	Mean Length	604	613	552	538	385
	SE	5.1	8.6	3.7	12.7	1.7
	Sample Size	27	8	72	4	105
Downstream Escapement[3]						
Female	Mean Length	570	568	560	522	
	SE	4.6	1.8	11.6	13.6	
	Sample Size	15	149	3	3	
Male	Mean Length	610	612		577	388
	SE		1.9		9.8	4.4
	Sample Size	1	127		6	3
Confluence Harvest[4]						
Female	Mean Length	580	581	557	539	
	SE	4.5	4.6	2.3	3.5	
	Sample Size	13	25	78	14	
Male	Mean Length	603	596	559	553	
	SE	4.6	5.4	3.1	13.6	
	Sample Size	26	27	64	6	

[1] Fish that migrated through the weir.
[2] Standard error.
[3] Late run fish that spawned downstream from Russian River Falls.
[4] Late run only.